◆招聘講演◆

Hospital Restructuring's Impact on Outcomes (HRIO)

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Restructuring and Reengineering (R 2) have been underway in hospitals for the majority of the decade of the nineties. The objectives have been to reduce operating costs while maintaining and improving quality patient care. Managed Care, combined with the effects of The Balanced Budget Act of 1997, ensure that R 2 activities will continue into the next millennium. The quest continues to be to reduce operating expenses while improving care and services to patients and families. Attracting patients and payers is important to the survival and success of hospitals in the managed care environment in which we all live.

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As the decade of the nineties began, hospitals searched for cost reduction strategies. Consultants advised the hospital industry that their largest budget expense was labor and that the largest labor savings were to be found in the nursing budget.[1] One of their major recommendations for cutting hospital expenses was to reduce nursing budgets by reducing the number of Registered Nurses (RNs) and using more unlicensed assistive personnel (UAPs).[2] The outcome was purported to be lower costs with no reduction in quality. This strategy was widely adopted. However, while nursing budgets were being cut, other departments were restructuring and shifting increasing numbers of functions to patient care units and the reduced nursing staff. Simultaneously, managed care regulations resulted in controlling patients' admissions to hospitals as well as their lengths of stay (LOS). Thus, patients who were admitted had an ever-increasing acuity／severity of illness with the associated needs for complex nursing care. There has been no safety net that represents the minimal level of nursing care that patients in acute care hospitals require to assure quality. There are no universally accepted acute care industry standards for the hours of care or the mix of staff and support systems required to deliver care to various homogeneous categories of

patients. The urgency to reduce costs has not been coupled with an evaluation of the cost reduction's impact on patient care and health outcomes. Costs are being reduced but what price is being paid? What is the impact of these changes on patients and families, the quality and outcomes of their care, including satisfaction? What is happening to staff satisfaction?

Because R 2 is continuous and additive, there is a growing uneasiness of their impact on quality care. Early in the decade of the nineties, the U. S. Congress was inundated with anecdotes of poor quality care from their constituents. Congress' response was to commission the Institute of Medicine (IOM) to do a study of staffing and quality care and report back their findings. The IOM study resulted in the report, *Nurse Staffing in Hospitals and Nursing Homes. Is it Adequate? (1996)*.[3] and provided the context in which this HRIO study was funded by The National Institute of Nursing Research. The IOM Study concluded that there was a serious paucity of research on definitive effects of structural measures, i. e., specific staffing ratios on quality of care in terms of outcomes. The lack of systematic and ongoing monitoring and evaluation of staffing on patient outcomes was emphasized. The study commission concluded that high priority must be given to obtaining empirical evidence the permits conclusions about the relationships of the quality of inpatient care and staffing levels and mix. They also found that there has not been a thorough examination of structural and process variables and their relationships to patient outcomes and costs. They concluded that it was imperative to extend research to multiple national sites that would collaborate and agree on definitions of variables and collect and report data in a uniformly consistent manner.

The HRIO Study Methodology

The HRIO Study Aims

- To describe the R 2 changes in the organization and delivery of patient care.
- Determine the inter-relationships of selected structure, process and outcome variables.
- Evaluate relationships of skill mix and worked nursing hours per patient day (WNHPPD) to patient outcomes and determine if data suggest standards supportive of quality outcomes.
- Provide data to determine if mid-course corrections are advisable.

The HRIO Sample

The participants were a convenience sample of 29 University Teaching Hospitals (UTHs) that had greater than 300 operating acute care adult beds. These UTHs were all members of the University Health System Consortium and, when the study began, were all participants in a Mecon labor benchmarking program. The UTHs represent 8 of the 9 U.S. Census Regions. When the study began, there were 32 UTH participants with all census regions represented. However, 2 UTHs had executive level changes and withdrew from the study and 1 UTH was asked to withdraw

because they did not have the resources to meet the demands of the study.

The HRIO Study Design

HRIO was a 4 year descriptive study that began in 1996 and ended in 2000. Hospital data were collected in fiscal years (FY) 1997 and 1998. Each UTH was assigned a code number and confidentiality was assured. The study used a nested design, that is, the investigators collected data to view the hospital/nursing department (HND) macroscopically, as well as data to examine a designated medical (M) and Surgical (S) unit in each UTH for the microscopic view. To be designated as a study unit, the following criteria prevailed: the unit could be of varying size, determined by the site; may include telemetry; may include intermediate/step-down beds; may not include intensive care beds; and cares for acute adult patients only.

The HRIO conceptual model was based on Avedis Donabedian's construct that structure affects process and structure and process combine to effect outcomes.[i] The HRIO construct, as illustrated in Figure 1, modified the original linear construct of Donabedian and proposed that the structure, process and outcome variables interact and influence each other. The structure variables investigated were: the Stage of Marketplace Evolution (the extent of managed care penetration and consolidation of the hospital market in the respective geographic area); R2 Interventions

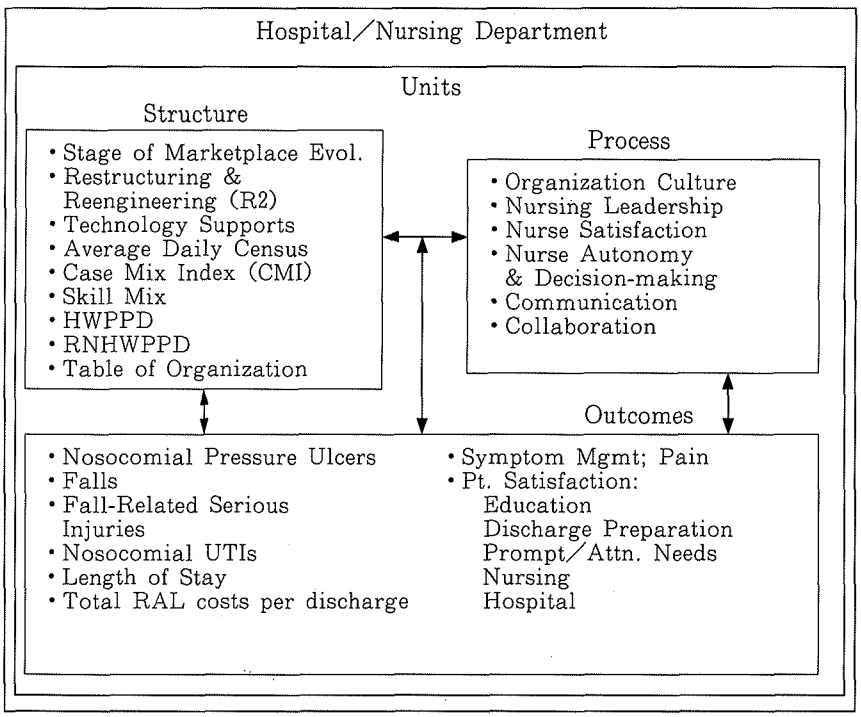

Figure 1. *HRIO Conceptual Model*

and Strategies ; Technological Supports available to caregivers ; Average Daily Census ; Case Mix Index (CMI), Skill Mix (per cent RN and other care giving staff) ; Hours Worked Per Patient Day (HWPPD) ; Registered Nurse Hours Worked Per Patient Day (RNHWPPD) ; and Table of Organization of the UTH. The process variables included the Organizational and Unit Culture, Nursing Leadership, Nurse Satisfaction, Nurse Autonomy and Decision Making ; Communication and Collaboration. The outcome variables were : Nosocomial Pressure Ulcers (NPUs) ; Falls and Fall Related Serious Injuries ; Nosocomial Urinary Tract Infections (UTIs); Symptom Management-Patient Satisfaction with Pain Management; and Patient Satisfaction with the Hospital, with Nursing, with Attention to Meeting Needs／Promptness, with Education Received while in the Hospital Regarding Care, Tests and Treatments, and with Education That Prepared Them For Discharge ; Length of Stay (LOS) ; and Total Regionally Adjusted Labor (RAL) Costs per Discharge. The latter is a revision in the study design since the original outcome variable, the Total Facility Expenses with Regional Adjusted Labor per CMI Weighted Discharge, was unavailable to the Study in the majority of sites.. Since the study focus was on staffing and outcomes, using total RAL labor costs per discharge was evaluated as an appropriate substitution and data were readily available at the levels of the HND and study units.

Data were collected using a standardized approach across all UTHs. Selected structure variables were collected from the UHC Mecon labor benchmarking data or equivalent data collection forms designed by the HRIO research team. In FY 1998, 18 UTHs had complete Mecon structure data and 11 used equivalent data collection forms. In FY 1999, 29 UTHs used equivalent data collection forms since none were participants in the Mecon program by that time period. The R2 Assessment Instrument, along with annual site visits that included 2 hour interviews with the Chief Nurse Executives (CNEs) also were used to collect selected structure and process variables. However, the Individual Nurse Questionnaire provided the majority of data for the process variables. Quality management data with agreed upon variable definitions and data collection procedures were the source for outcome variables, along with data from the respective financial offices. More will be said about each of these as the variables are discussed and data presented.

The R2 Assessment Instrument. The R2 Assessment Instrument is a 100 item survey of restructuring and reengineering interventions grouped into 8 areas: culture ; reorganization of nursing, expanded roles and functions ; technological supports ; centralized nursing support ; decentralized nursing support ; new／expanded patient care programs and hospital changes; and hospital-wide management interventions. The R2 Assessment Instrument was developed by Sovie (1995) with the assistance of 15 CNEs. The R2

Assessment Instrument was completed by the CNE at each UTH and forwarded to the HRIO research office. When it was received, a site visit was scheduled that included a structured 2 hour interview with the CNE in which data were reviewed and elaborated upon and further information was elicited through the completion of the structured interview guide. In year 2, the CNE was given the completed R 2 Assessment Instrument from the prior year and asked to indicate changes or additions only. A totally revised interview guide was used in year 2. All interview data were entered into a specially constructed data base to allow for aggregation of and analysis of replies. In year 2 site visits, presentations were made to the respective CNE and staff regarding the HRIO study's importance to the field and progress to date.

R 2 Assessment Findings

Nursing Departments had been involved in R 2 activities longer than the hospitals as a whole. One-half of the sites had been involved in R 2 activities for greater than 4 years.

Collective bargaining Collective bargaining existed in 22 of the UTHs, and 19／22 had nursing staff in unions. RNs and Licensed Practical Nurses (LPNs) were included in 14／19 collective bargaining agreements, and UAPs in 15／19. The union presence or absence was not a factor in the pace of R 2 interventions or the changes in nursing care delivery. The union was considered another stakeholder to be included as the R 2 activities were planned and implemented.

Culture Culture was recognized as an important structure and process variable. The majority of CNEs (96%), along with their leadership staff were engaged in making deliberate culture changes designed to support R 2 interventions. The culture changes were tailor-made for each institution and were dependent on the unique characteristics and particular challenges that the individual UTH faced. These academic teaching hospitals were in constant white water. Many confronted sentinel events that were defined as major changes in the organization with potential to affect structure, process and outcome variables. Sentinel events faced by UTHs included mergers, executive leadership changes, reductions in force, rapid restructuring, and relocating hospital services and units to other network facilities. Some of the cultural issues that resulted from the sentinel event of merger or changed ownership serve as an example of organizational turmoil that the leadership had to address through planned culture building. These issues included : culture clash when 2 different institutional cultures were forced to become one. In some instances, the culture became one of chaos and uncertainty with competing institutional orientations ; employees grieving for losses in benefits and changed work relationships. Support system failures occurred in one merger with the loss of a functioning infrastructure. Decision making became more centralized in several UTHs.

Culture building strategies that were implemented by the leadership team included the creation of interdisciplinary teams at all levels of the organization. Attention was directed to increased and improved communications with the staff and the increased visibility of the CNE and other leadership staff. Participative management structures were reenergized or put in place where they did not exist. Improving nurse／physician relationships and collaboration received special attention along with efforts to overtly demonstrate valuing of the RN staff and their unparalleled contributions to patient／family care. Professional nursing practice／primary nursing became a focus along with leadership development and empowerment of the management and staff.

Major R2 Interventions Including The Structure Variables. Cost reductions drove the major R2 interventions and the interventions started at the top of the hospital nursing structure. The CNE responsibilities were expanded to include patient services in 97% of the UTHs. Nursing Departments were consolidated and the number of Nursing Directors reduced. The remaining Directors had a broadened span of control. Management levels were reduced. Nurse Managers (NMs) were reduced in number and NM responsibilities were expanded to include multiple units in 91% of the sites. In 47% of the sites the NMs' span of control was increased to include unit based staff from Environmental Services, Dietary and Transport. Assistant NMs (ANMs) were reduced in number or eliminated in 68% of the sites. These management changes resulted in a reduction of direct management support in the patient units at the same time that reduced numbers of RNs were expected to supervise increased numbers of UAPs and care for sicker patient who had a reduced LOS. Table 1 displays summary statistics for RN skill mix, that is the percentage of RN staff in FY 97 and FY 98. UAPs were involved in patient care in all sites and their roles had been expanded in the majority of UTHs. Multi-skilling occurred with both RNs and UAPs.

Other staffing restructuring involved conversion, in FY 97, of many Clinical Nurse Specialists (CNSs) to Nurse Case Managers. This occurred in 88% of the sites. However, in FY 98, the CNEs wanted CNSs to function

Table 1. RN Skill Mix (Percentage of RN Staff)

Unit Analysis	FY	n	Range	Mean	Median	SD
HND	97	29	46.9−84.4	61.41	60.66	7.89
	98	28	44.0−75.4	60.30	59.78	6.77
M	97	27	39.1−73.3	56.07	55.47	10.22
	98	27	39.6−81.8	56.77	57.49	9.06
S	97	27	36.6−81.1	57.04	57.95	12.42
	98	27	33.6−83.6	56.02	56.10	10.83

in their classical roles as expert clinicians who deliver or manage specialized nursing care and develop nursing staff. This rebirth of the CNSs role occurred in 23／29 (79%) of the sites. Nurse Practitioners were functioning in all sites and Nurse Midwives were in 23／29 (79%) of the UTHs. Nurse Researchers were in 18／29 (62%) of the sites. It is interesting to note that the reduction in the number of nurse managers, and the responsibility for multiple units was a restructuring intervention that was reversed in 6／29 (21%) UTHs in FY 98. Four sites never implemented such reductions in NMs. When the latter are combined with the 6 reversals, the total is 10／29 (34.5%) UTHs who again have a nurse manager for each unit. Lack of the on-site NM led to lack of necessary support to staff and difficulty in succession planning according to many CNEs. In those sites where reduction in NMs was successful, a substitute role of nurse leader／manager was created to fill the void of the NM. Other R 2 interventions that were implemented and their cumulative prevalence over the 2 data collection years are listed in Box 1.

Influence of Market Stage The market stage influenced restructuring. As the UTHs advanced in the market stage, that is, as they found themselves with a higher penetration of managed care and increased competition, management full time equivalents (FTEs) were decreased. This was true in both FY 97 and FY 98. HWPPD were lowest in those UTHs in stage 3 (Consolidation) marketplace, and in FY 98, 10 UTHs identified themselves in this stage, with 5 stating they were in stage 4 (Managed Competition) and 3 declaring they were in stage 5 (Hypercompetitive). Ten UTHs identified themselves as in stage 2 Loose framework in FY98. In Stages 4 and 5, UAP HWPPDischarge were greater than in other stages. RNHWPPD increased in stages 4 and 5 in FY 98. The investigators speculate that the manpower reductions, as a result of the threat of greater managed care penetration, were too severe and this became obvious while the institutions were in stage 3. By the time the UTHs had reached stages 4 and 5 they had added back HWPPD to help meet patient care demands.

Process Variables

The Individual Nurse Questionnaire (INQ) was used to collect the process variables. The INQ was excerpted, with permission, from Shortell & Rousseau's The Organization and Management of Intensive Care Units (Copyright 1989).[6] Seventy-seven items with a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) were taken from the latter. A 4-item subscale on decision-making was taken from The Quality of Employment Survey by Quinn & Shepard (1974).[7] This subcale used a 4 point Likert scale ranging from 1 (a lot) to 4 (not at all). The reliability and validity of the selected items were established by the developers. Reliability (Cronbach's Alpha) for the 81 INQ items with the HRIO sample of FY 97 was 95%.

Box 1. R 2 Interventions and Prevalence in UTH Study Sites

R2 in ≧ 90% of Sites

1. Deliberate efforts to create culture changes in Nursing and in Institution to support R2
2. Nurse Managers span of control increased.
3. Selected nurse managers' controls include more than one unit.
4. Advanced Practice Nurse roles employed
5. Nurse case managers employed
6. Continuous patient satisfaction improvement activities ongoing
7. Clinical Pathways developed and implemented
8. Cost-effectiveness programs with mandated targets exist.
9. Personnel hiring controlled in hospital.
10. ETEs reduced without layoffs or terminations.
11. UHC purchasing program operational
12. Products evaluation committee operational
13. Direct deposit for employee paychecks

R 2 in 70%-79% of Site

1. Multi-skilled workers employed
2. Advance Practice Nurses' roles expanded
3. Intermediate care units/beds expanded
4. Office of Outcomes Evaluation & management created to include all quality initiatives.
5. Employee satisfaction surveys done annually or periodically.
6. Indiscriminate use of medical/surgical supplies controlled
7. Employee suggestions used to reduce costs.
8. Employees on workers' compensation used as patient sitters or in alternative

R2 in 50%-59% of Sites

1. Nurse Managers supervise other than nursing staff, e. g., housekeepers, transporters
2. Nurse research position exists
3. Full time quality improvement coordinator supports unit-based QI
4. Nursing assistants roles expanded
5. *Unit Secretaries/Clerks roles expanded*
6. Centralized nursing support positions created, e.g., work redesign coordinator, professional practice coordinator
7. Decentralized environmental services dept. (housekeeping) to unit with reporting structure to Nurse Manager.
8. Short-Stay Centers developed
9. Home Health services operational
10. Palliative Care service operational
11. Career Transition Center established to assist employees involved in R2

R2 in 80%-89% of Sites

1. Nursing Depts. climinated/combined to reduce number of directors/asst. directors.
2. Nurse Managers span of control increased
3. Nurse Managers roles expanded
4. *Nursing responsible for off-shift weekend* hospital supervision.
5. Nursing assistants employed
6. Forms Eval. & Standardization Committees.
7. Patient Units consolidated where feasible

R2 in 60%-69% of Sites

1. Assistant Nurse Manager positions reduced in number or eliminated.
2. RNs roles expanded
3. Nursing staff orientation decentralized to unit with designated staff development coordinator designated
4. Patients aggregated based on nursing and ancillary needs and continuum of care
5. Daily admissions/patient placement meetings held.
6. Volunteers integrated into work with patients.
7. Home infusion Service operational
8. Hospital supply use including laundered scrubs controlled
9. Policies and procedures for reducing workforce created
10. Just-In-Time Inventory program exists

The INQ was distributed to all RNs on the study medical and surgical units and a 20% sample of RNs working in other adult acute units of the respective UTH. Anonymity was assured and participation was voluntary. Answers were recorded by the participating RNs on scannable answer sheets that were forwarded to the HRIO research office for analysis. Responses were received from 1917 RNs (46%) in FY 97 and 1609 RNs (36.5%) in FY 98. In both years, the RN respondents varied in educational preparation. However, in each year, greater than 65% of the respondents had a B.S. or higher degree, with over 50% with a BS in Nursing. The INQ responses of FY 97 were factor analyzed and the result was 11 factors plus nurse satisfaction. Table 2 presents the named factors. The relationships of these factors with selected structure and outcome variables will be discussed after the outcome variables and their data are presented.

The Outcome Variables

Each of the nurse-sensitive outcome variables are defined and the associated data collection measures and summary data are presented in this section.

Patient Falls. Patient falls were defined as any slip or fall in which the patient comes to rest unintentionally on the floor. They included assisted and unassisted falls and witnessed and unwitnessed falls. The data source was incident reports and the data are reported in falls per 1000 patient days.

Fall Related Serious Injuries. Fall related serious injuries also used incident reports as the data source and included fractures, head injuries and major wounds requiring suturing or re-suturing. The data are reported as the per cent of patients who fall and experience serious injury or serious injury per 100 falls. Tables 3 and 4 present the summary data for these 2 outcome variables. The investigators have concluded that the fall related serious injury rate is more a condition of the individual patient's frailty than an outcome sensitive to nursing interventions. In future studies, this variable will not be included.

Nosocomial Pressure Ulcers (UPUs). NPUs were defined as any lesion greater than Stage 1, caused by unrelieved pressure resulting in damage of underlying tissue not present on admission.[8] A point prevalence direct observation

Table 2. *Individual Nurse Questionnaire (INQ) 11 Factors Plus Nurse Satisfaction*

Factors	Factors
Communication	Achieving Quality Pt/Family Outcomes
Collaboration	Inter-Unit Relationships
Conflict Resolution	Nurse/Physician Recruitment & Retention
Leadership and Nursing Staff	Nurse Autonomy
Fiscal and Patient Care Authority	Nurse Decision-Making
Information Exchange	Nurse Satisfaction

Table 3. *Patient Fall Rate Summary Statistics (Falls per 1000 Patient Days)*

Unit Analysis	FY	n	Range	Mean	Median	SD
HND	97	29	.006−5.43	2.88	2.75	1.20
	98	29	1.20−5.02	2.95	2.79	0.91
M	97	29	0−8.46	3.97	3.49	2.10
	98	28	1.11−8.84	4.11	4.35	1.68
S	97	29	0−4.82	2.42	2.72	1.41
	98	28	0.88−4.47	2.69	2.79	1.19

Table 4. *Fall Related Serious Injury Rate Summary Statistics (Serious Injuries per 100 falls)*

Unit Analysis	FY	n	Range	Mean	Median	SD
HND	97	29	0−15.49	3.27	2.08	4.18
	98	28	0−24.05	4.20	2.35	5.81
M	97	29	0−23.33	4.38	0.00	6.39
	98	27	0−49.60	4.70	0.00	10.41
S	97	29	0−41.67	4.06	0.00	10.06
	98	27	0−37.50	5.88	0.00	10.65

Table 5. *Nosocomial Pressure Ulcer Rate Summary Statistics (Percentage of Patients with NPUs per Total Patients Evaluated)*

Unit Analysis	FY	n	Range	Mean	Median	SD
HND	97	29	0.53−8.42	3.53	3.23	1.82
	98	29	0.23−8.83	3.14	2.63	1.73
M	97	28	0 −9.87	2.61	1.81	2.56
	98	28	0 −8.28	2.23	1.71	1.94
S	97	28	0 −9.83	2.68	2.40	2.22
	98	28	0.35−5.35	1.88	1.43	1.33

data collection methodology was used. Data were collected one day each month on the 2 designated study units as well as on all adult acute care units throughout each UTH. The NPU rate was determined with the numerator as the number of patients with NPUs (Stage Ⅱ, Ⅲ, Ⅳ, or unstageable) over the denominator which was the total number of patients that were evaluated. All nurses who staged ulcers were certified after successfully completing an educational program created by an HRIO investigator that included a set of 9 test slides illustrating different stages of pressure ulcers. Table 5 presents the NPU summary data.

Nosocomial Urinary Tract Infections (UTIs) UTIs were defined as a UTI identified greater than 72 hours post-admission. The standard definition of the Center for Disease Control (CDC), and National Nosocomial Infection Surveillance (NNIS), was used and provided on the data collection form to each institution. Data were collected quarterly for each of the designated study units and all acute

adult units throughout the UTH. In some UTHs the data were provided by Infection Control or a similar department. In other UTHs, the data were collected by retrospective chart review using a random sample of 5% of the discharges from the respective study units and 2% of the discharges from all other adult acute care units in the UTH. The rate is the number of patients with UTIs per patients discharged or charts sampled. Table 6 presents the summary data.

Symptom Management: Patient Satisfaction with Pain Management. The single outcome variable in the HRIO study that related to symptom management was Patient Satisfaction with Pain Management. Patients were asked to evaluate their pain management with either of 2 questions, depending on the instrument used. The Press Ganey instrument asked the patient to evaluate how well pain was controlled. The Picker instrument asked the patient if he or she thought that the hospital staff did everything they could do to help control your pain. Institutions that used other instruments were asked to include a question similar to either of the above.

Patient Satisfaction. The study included 5 patient satisfaction variables sensitive to nursing. These were Satisfaction with: The Hospital; Nursing; Education received while in the hospital relating to tests and treatments and other care; Education preparing them for discharge; and Attention to Needs/Promptness. Tables 7 and 8 present the patient satisfaction summary statistics. These variables are presented as the percent satisfied.

The mean ratings of all the patient satisfaction variables measured indicated that much work remained to be done to realize the outcome of high levels of patient satisfaction in these measured areas. It is notable that patients rated their satisfaction with nursing the highest of all areas. Unit level patient satisfaction means were lower than those at the HND level.

Patient Satisfaction with the Hospital is an important outcome variable in the competitive marketplace. When patients are satisfied they and their family members or significant others will return when future care is required and they will also let friends

Table 6. *Nosocomial UTI Rate Summary Statistics*
(Percentage of UTIs per Patients Discharge or charts sampled)

Unit Analysis	FY	n	Range	Mean	Median	SD
HND	97	26	0−6.00	2.64	2.44	1.67
	98	27	0−4.72	2.02	2.34	1.43
M	97	26	0−7.92	2.17	1.63	2.49
	98	26	0−9.90	2.61	1.71	2.56
S	97	26	0−9.50	1.87	1.20	2.29
	98	26	0−7.40	2.45	1.86	2.24

Table 7. *Patient Satisfaction Summary Statistics HND*

Patient Satisfaction	FY	n	Range	Mean	Median	SD
Pain Mgmt	97	23	84.1	84.6	6.4	68.6−97.7
	98	25	83.9	84.5	5.9	69.2−94.7
Education	97	28	79.4	80.2	8.7	65.6−94.0
	98	26	79.3	80.7	7.8	64.6−93.8
Discharge Prep	97	27	80.2	80.1	7.4	66.1−94.0
	98	27	78.9	80.9	7.7	66.5−93.2
Prompt./Attn Needs	97	26	81.9	81.5	7.6	66.4−95.1
	98	26	80.5	81.3	7.8	64.8−96.6
Nursing	97	15	87.0	86.4	5.2	77.7−94.0
	98	16	85.3	85.8	6.5	71.5−95.7
Hospital	97	27	83.5	83.7	7.2	69.4−97.0
	98	27	81.9	83.0	7.6	68.9−96.3

Table 8. *Patient Satisfaction Summary Statistics for Study Medical and Surgical Units FY 1997 and 1998*

Patient	*FY*	Median				Surgery			
Satisfaction		n	Mean	SD	Range	n	Mean	SD	Range
Pain mgmt.	97	21	83.04	9.92	50.00−97.09	19	85.55	6.77	72.30−98.21
	98	24	83.31	7.82	57.00−97.30	25	85.92	4.63	72.80−97.00
Education	97	23	77.88	8.43	58.20−87.40	21	78.59	6.78	64.89−95.00
	98	25	77.60	8.53	63.23−93.00	26	78.49	8.14	61.30−94.33
Discharge Prep	97	23	78.84	7.92	60.47−89.40	22	77.95	8.21	59.80−92.50
	98	26	78.73	8.29	59.25−94.12	27	79.14	7.71	63.70−92.00
Prompt./Attn to Needs	97	23	81.06	9.59	56.84−98.75	21	78.53	8.39	59.85−92.86
	98	25	78.41	7.78	60.39−91.43	26	79.95	6.14	64.43−93.60
Nursing	97	12	83.60	5.89	67.50−88.00	12	82.82	6.54	69.10−91.00
	98	15	83.82	5.67	72.25−94.44	16	84.90	6.99	66.18−92.94
Hospital	97	23	82.36	8.37	62.96−97.50	21	82.91	7.14	62.77−94.00
	98	25	81.89	5.43	69.42−90.50	26	81.79	8.48	59.58−93.67

and acquaintances know of the excellent care and service they received. When dissatisfied, the hospital has lost potential customers and many more individuals or groups who will be informed of the dissatisfaction and the reasons for same.

Nursing, as the discipline responsible for the majority of direct care the patients receive, is a key structural variable in effecting patient satisfaction. This was demonstrated with the strong correlations of selecte patient satisfaction variables with the varia ble Satisfaction with the Hospital. In bot FY 1997 and 1998 Patient Satisfaction wit the Hospital was positively and significantl correlated with the activities where nurse have primary responsibility. These includ the education the patients receive while i the hospital that relates to their care, test and treatments; the education that prepare them for discharge, and their satisfactio

with pain management.

Structure, Process, and Outcome Relationships

Hours Worked per Patient Day (HWPPD), RN% and Registered Nurse Hours Worked Per Patient Day (RNHWPPD). HWPPD, RN % and RNHWPPD were hypothesized as the structural variables that have significant impact on outcomes. RNHWPPD were calculated by multiplying the HWPPD and RN%. Table 9 presents the summary statistics for RNHWPPD.

Table 10 presents selected structure, process and outcome variable correlations with HWP PD, RN% and RNHWPPD using data from FY 1997 and FY 1998. HWPPD correlated negatively with the Fall Rate, NPU Rate, UTI Rate, Patient Satisfaction with Pain Management, Patient Satisfaction with Promptness and Attention to Needs and Patient Satisfaction with Nursing. As the HWPPD went up, the Fall rate, NPU and UTI rate went down. However, as HWPPD increased, Patient Satisfaction with Pain Management, Promptness and Attention to Needs and Patient Satisfaction with Nursing decreased. Nurse satisfaction increased as HWPPD increased.

RN% was evaluated in relation to other types of personnel resources involved in the patient care units. The findings were consistent across all categories of staff. As RN% increased, the other categories of personnel decreased.. These included HWPPD, Paid FTEs, LPNs, Other Professional %, UAP %, Other % and Management %. RN% had significant positive correlations with selected process variables. As RN% increased, Collaboration Nurse to Nurse (N-N) increased, as did Communication N-N, Communication Nurse to Physician (N-P) and Conflict Resolution N-N. RNs' confidence in Nursing Leadership and Achieving Quality Patient/Family Outcomes increased with the RN% as did Nurse Autonomy, Nurse Satisfaction and Nurse Decision Making (except in the Surgical Units where the correlation was positive, meaning that as RN % increased, Nurse Decision Making decreased). RN% also had significant positive correlations with several outcome variables. As RN% increased, the NPU rate decreased. Patient Satisfaction with Pain Management and Patient Satisfaction with Nursing increased as the RN% increased.

Table 9. *RNWHPPD Summary Statistics*

Unit Analysis	FY	n	Mean	Median	SD	Range
HND	97	28	8.45	8.20	1.49	6.41−13.75
	98	28	8.09	8.25	1.60	4.88−10.68
M	97	27	5.10	5.04	1.00	3.22− 7.20
	98	27	5.52	5.25	1.65	2.90−10.03
S	97	27	5.18	4.97	1.08	3.30− 7.48
	98	27	5.15	5.21	0.88	3.00− 6.62

Table 10. *Selected Structure, Process & Outcome Correlations*

Structure Variable	Structure/Process Outcome Variables	F Y	HND r	HND p	C r	C p	M r	M p	S r	S p
HWPPD	Fall Rate	97	-.578	.001	-.300	.029				
	NPU Rate	98	-.350	.068						
	UTI Rate	97					-.345	.099		
		98			-.239	.094	-.416	.039		
	Pt. Sat. Pain Management	97			-.300	.029	-.655	.001		
		98							-.429	.036
	Pt. Sat. Prompt/Attn to Needs	98					-.387	.062		
	Pt. Sat. Nursing	98			-.330	.081				
	Nurse Satisfaction	98			.306	.035			.347	.089
RN%	HWPPD	97			-.512	.000	-.556	.003	-.439	.025
		98			-.384	.004			-.554	.003
	Paid FTEs	97			-.385	.004	-.370	.063		
		98	-.424	.028						
	RAL Exp./CMI wtd. adj. Disch.	97	-.204	.339						
		98	-.032	.878						
	RAL Exp. Per Disch.	97			.003	.986	-.065	.768	.067	.781
		98			-.158	-.267	-.184	.379	-.107	.603
	Collaboration N-N	98					.339	.097		
	Communication N-N	97	.573	.001						
		98	.319	.099						
	Communication N-P	97	.339	.077						
	Conflict Resolution N-N	97	.359	.061						
	Achiev. Qual. Pt Fam. Outcomes	97	.488	.008						
	Unit Nursing Leadership	97	.385	.043						
		98					.404	.045		
	Nurse Decision Making*	97	-.344	.074					.338	.091
		98					-.374	.066	.352	.085
	Nurse Autonomy*	97	-.323	.094						
		98					-.410	.042		
	Nurse Satisfaction	97	.324	.092						
		98			.260	.069	.501	.011		
	NPU Rate	97			-.247	.084				
	Pt. Sat. with Pain Mgmt.	97	.380	.074	.420	.007	.619	.003		
		98			.284	.053				
	Pt. Sat. with Nursing	97			.371	.090				
		98	.485	.057	.389	.037				
RNHWPPD	Fall Rate	97	-.381	.045	-.387	.004	-.422	.028	-.386	.052
	NPU Rate	97					-.406	.044		
		98	-.364	.057						
	LOS	98			-.414	.001	-.548	.004		
	Communication N-P	97			.306	.034				
		98			.296	.037				
	Nurse Autonomy	97	-.384	.048						
	Nurse Satisfaction	98					.466	.025		

*4 Point Scale Reversed : 1=A lot, 2=Sometimes, 3=A little, 4=Not at all.
revised 2-8-2000, M.D. Sovie, HRIO

Since the rhetoric with restructuring included the necessity to reduce RN staff to reduce labor expense, the investigators believed it was important to identify the relationship between RN% and RAL Costs per discharge. Table 10 includes these correlations. There were no significant relationships between RN% and Regionally Adjusted Labor (RAL) Expenses per Discharge at any level in the organization in either year of data collection.

The variable RNHWPPD provides the opportunity to identify specific correlations with the hours of care provided by Registered Nurses. As RNHWPPD increased, the Fall Rate and NPU rate decreased as did LOS. The process variables, Communication Nurse to Physician (N-P), Nurse Autonomy and Nurse Satisfaction also increased with the increase in RNHWPPD.

Nurse Autonomy and Nurse Decision Making are important process variables, as identified originally in The Magnet Hospital Study[9] and subsequently in Aiken, Smith and Lake's research on Magnet Hospitals.[10] In this HRIO study, there are mixed results with the correlation of Nurse Autonomy, Nurse Decision Making and outcomes. Table 11 presents the specific correlations as they were identified in each of the respective data collection years, i.e., FY 1997 and 1998. Nurse Autonomy increased as the NPU and Fall Rate increased on the Medical Units. In contrast, on the Surgical Units, a decrease in Nurse Autonomy was associated with an increase in the Fall, NPU and UTI rates. With the remaining outcome correlations reported, the findings were consistent in all areas. As Nurse Autonomy increased, Patient Satisfaction with Pain Management increased as did Patient Satisfaction with Education and Nursing.

Nurse Decision Making increased as the Fall Rate increased in the Medical Units in FY 98. However, with FY 97 data, Nurse Decision Making at the HND level decreased as the Fall Related Serious Injury Rate increased; and in FY 98, the correlation was reversed, i.e., Nurse Decision Making increased as Fall Related Serious Injury Rate increased. Nurse Decision Making correlated positively with the NPU rate with Medical Units'data in FY 98. This correlation means that Nurse Decision Making scores decreased as the NPU rate increased. In all other outcomes, as Nurse Decision Making increased, Patient Satisfaction increased. This included Patient Satisfaction with Pain Management, and Patient Satisfaction with Education, Discharge Preparation, Nursing and the Hospital.

HRIO Study Limitations

- In FY 1997, three UTHs left the study. Two withdrew as a result of new Executive Leadership and one was asked to withdraw because it was unable to meet study participation requirements. The sample became 29 UTHs.
- In FY 1998, one UTH was in executive turmoil. The latter UTH's newly appointed CNE stated that there had been such extensive leadership turnover that there was no

Table 11. *Selected Process & Outcome Correlations*

Process Variable	Outcome Variable	FY	HND r	HND p	C r	C p	M r	M p	S r	S p
Nurse	Fall Rate	97							.399	.039
Autonomy*		98					-.341	.089		
	UTI	97							.457	.022
	NPU Rate	98			.384	.005	-.468	.016	.366	.066
	Pt. Sat. Education	98			-.317	.028			-.354	.090
	Pt. Sat. Nursing	98			-.385	.043	-.560	.037		
	Pt. Sat.: Pain Mgmt.	97	-.365	.095						
		98			-.254	.089				
Nurse	Fall Rate	98					-.351	.079		
Decision	Fall Related SIR	97	.487	.009						
Making*		98	-.484	.011						
	NPU Rate	98					.333	.097		
	Pt. Sat. Pain Mgmt.	98			-.276	.063	-.388	.067		
	Pt. Sat.: Education	97			-.349	.029	-.430	.066		
		98			-.249	.087				
	Pt. Sat.: Discharge Prep	97			-.365	.020	-.544	.016		
		98			-.236	.098				
	Pt. Sat.: Nursing	98			-.334	.083				
	Pt. Sat.: Hospital	97					-.439	.060		
		98			-.317	.028	-.367	.078		

*4 Point Scale Reversed: 1=A lot, 2=Sometimes, 3=A little, 4=Not at all.
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institutional memory and collectively, they were unable to complete parts of the data submittal.

- Different patient satisfaction survey instruments were used by the UTHs along with different scoring methods. The majority used either Press-Ganey or Picker. Scores were translated to equivalent scales for analysis.
- All stites did not report data for every variable.
- The only risk adjuster used was the UTH's Case Mix Index.
- There were only 2 quarters for concurrent data collection in FY 1997.
- The INQ rate of participation was 46% in FY 97 and 36.5% in FY 98.
- Changes were continuous during the period of the study as would be expected in a dynamic health care environment.

HRIO Study Conclusions

- R2 interventions were extensive across th UTHs with many commonalities.
  - CNEs were responsible for Nursing an Patient Services.
  - Nurse Directors and Nurse Manager were reduced in number and spans o control broadened.
  - The number of RN staff nurses wa reduced.
  - The number of UAPs was increased.
- The impact of R2 on quality of care o costs was not systematically evaluated b the UTHs.
- A variety of nursing care delivery model

were identified. These models included Professional Practice／Primary Nursing in 8 UTHs ; no specific model in 7 UTHs ; Team in 5 UTHs ; Patient-focused Care in 2 UTHs ; and Care Partners in 2 UTHs. In 1／3 of the sites the impact of the model of patient care delivery on outcomes including costs was not evaluated.

- Structure and process variables interacted to affect outcomes, and outcomes in turn affected structure and process.
- Patient Satisfaction with the Hospital was directly related to their Satisfaction with Nursing, Education received while in the hospital relating to their tests, treatments, and their Satisfaction with their Discharge Preparation.
- RN% was not the labor cost driver. FTEs and HWPPD drove labor costs.
- Optimal balance of RN%, UAP%, RNHW PPD and HWPPD were key structural variables influencing quality outcomes and controlled costs.
- Continuing education of all staff was essential to quality care and outcomes.
- Roles of CNSs in staff development and patient care were reaffirmed.
- UAP competencies have to match job functions. UAP preparation and continuing development varied widely and were important to achieving quality outcomes.
- Nursing Leadership was critical to required culture changes which included :
  - −N／P and N／N Collaboration, Communication and Conflict Resolution
  - − Nurse Autonomy and Nurse Decision Making
  - −Participative Management
  - −Teamwork
  - −Nurse Satisfaction
- Nurse Autonomy and Nurse Decision Making were important to decreasing adverse patient outcomes and increasing patient satisfaction.
- Nurse-Physician communication, collaboration and conflict resolution were essential to quality care and outcomes.
- Value in Patient Care equals quality／costs." Value does not come in one size fits all.
  - −No single manpower pattern resulted in best value
  - −Patterns for value must be tailor-made for each institution／unit.
  - −Institutional／unit support services affect the needed manpower pattern and the resulting outcomes

Value in Patient Care in this HRIO study has been identified using selected structure, process and outcome measurements and is illustrated in the Select Performance Profiles in Table 12, page 23.

- The structure variables used are the patient care staffing triad: HWPPD; RN%; and RNHWPPD. The staffing variable, RN%, is not sufficient by itself. The variables HWPPD and RN% are essential and together provide RNHWWPD. The 3 variables are necessary for a complete picture. Profiles S1 and S6 in Table 12 illustrate why RN% by itself is insufficient in providing useful staffing information, S1 has 83.60% RN and 4.96 RNHWPPD. S6 has 50.10%

Table 12. Select UTH Performance Profiles

	Structure				Process						Outcomes						
UTH	HWPPD	RN%	RN HWPPD	Nurse Aut.	RN Sat.	Comm N-N	Comm N-P	Conflict Resol. N-N	Conflict Resol. N-P	Nsg. Leader-ship	Fall Rate	SIR	UTI	NPU	Pt. Sat.	Pain Mgt.	LOS	RALCosts per Disch. $
HND1	14.90	71.70	10.68	1.71	3.97	4.16	3.65	3.81	3.87	3.71	1.78	0.51	2.80	2.63	91.59	93.13	5.2	1754.60
HND2	16.58	64.00	10.61	1.91	3.69	3.73	3.48	3.68	3.87	3.38	2.63	0.48	—	2.23	91.20	89.00	6.6	1626.02
HND3	15.80	55.30	8.74	1.82	3.65	3.83	3.54	3.48	3.49	3.35	2.54	24.05	2.80	1.55	89.62	94.69	6.6	1068.97
M4	14.90	67.30	10.03	1.35	4.70	4.68	4.18	4.03	3.87	4.05	2.06	0.00	0.01	0.00	91.20	86.39	3.6	954.87
M5	8.77	60.19	5.28	2.00	3.82	3.76	3.16	3.30	3.36	3.19	1.11	0.00	0.01	0.01	85.44	85.00	4.8	812.63
M1	7.96	70.20	5.59	1.43	4.15	4.38	3.92	3.77	4.00	3.91	5.03	0.00	0.00	0.01	90.62	91.00	3.4	642.70
S1	5.93	83.60	4.96	2.17	3.56	4.13	3.76	3.67	3.89	2.76	1.34	0.00	0.01	0.01	86.80	92.00	4.0	638.00
S4	10.60	59.10	6.26	1.25	3.33	3.37	3.93	3.94	4.00	3.67	1.93	8.33	0.02	0.00	82.73	86.45	4.7	960.82
S6	9.80	50.10	4.91	1.85	3.31	3.64	3.17	3.61	3.75	3.50	2.22	2.78	0.01	0.02	83.02	86.53	4.4	893.00

HND1 1042.5 FTEs, 2.3% LPN, 3.3% NA, 2.2% Mgmt, 14.2% other
HND2 1125.45 FTEs, 1% LPN, 9% SA, 15% NA, 3% Mgmt, 6% other
HND3 713 FTEs, 1% other prof.; 3.8 % LPN, 20.3 Pt, Care Tech, 8.7 SA, 18.4% other
M4 3.7% LPNs, 7.3% Pt. Care Tech; 5.9% Support Attd 4.2% NA: Cardiology incl. 4 intermediate beds
M5 25.5% NA; 2.3% Mgmt ; 11.95% other. Hem／Onc ; Gyn ; Internal Medicine
M1 2.3% LPN, 18.6% NA, 8.8% other. General Medicine
S1 3.3% LPN, 3.5% NA, 9.6% other, Ortho and General Surgery
S4 18.7% LPN ; 2.5% Pt. Care Tech ; 8.2% NA. General Surgery and Trauma
S6 2.7% LPN ; 17.7% Pt. Care Tech ; 6.4% Support Attd ; 2.9% NA. Ortho, GU, Plastic

RN and 4.91 RNHWPPD. The profiles also underscore the importance of having both hospital/nursing department and unit level acute care staffing data. There are remarkable differences between each as is expected since HND acute care data include the intensive care units with their higher staffing levels.

- The nursing process variables used, as measured by INQ component scores, are Nurse Autonomy, Nurse Satisfaction, Nurse Leadership, Communication N-N and N-P, and Conflict Resolution N-N and N-P.
- All study outcome variables were used: Fall Rate ; Serious Injury Rate ; Nosocomial UTI and NPU Rates; Patient Satisfaction (the 5 patient satisfaction variables were averaged for this representation only) ; Symptom Management: Patient Satisfaction with Pain Management ; LOS; and RAL Costs per Discharge.

These Select Performance Profiles are examples from 6 UTHs. HND1, M1 and S1 are data from the same institution. Study units M4 and S4 are also data from one institution. The other profiles are data from separate institutions. Together they represent varying value in patient care and illustrate that Value in Patient Care does not come in one size.

Policy Implications

Based on the findings from this HRIO Study, the investigators conclude that with the evidence known to date, there cannot be a single legislated staffing pattern that will assure quality patient care in all settings in all University Teaching Hospitals. Another study needs to be done using Community Hospitals to determine if the findings are generalizable to all hospitals. However, in the interim, one can legislate that the staffing triad of HWPPD, RN% and RNHWPPD be made reportable data at both the acute care unit and acute care hospital level for every institution that receives state and federal health care dollars. In addition, an expanded set of outcome data that includes the following set of nurse sensitive outcome variables must be included as mandatory data reporting at the unit and hospital level. These data include at a minimum the nurse sensitive outcomes identified in this study and other recently published studies on the relationships of nurse staffing and patient outcomes.[10, 12-18] The outcome veriables are Nosocomial Pressure Ulcers and Urinary tract Infection; Fall Rate (Serious Injury Rate is not recommended for inclusion as it is more related to patient frailty than nursing intervention) ; Patient Satisfaction with Pain Management, and 5 specific areas of patient satisfaction including satisfaction with the education they received while in the hospital with their tests, treatments and care ; discharge preparation; attention to needs/promptness; nursing; and the hospital. Mortality rate and LOS are data currently collected at the hospital level and should be continued. However, unit as well as hospital specific data also should be reported. All legislated data should be available to the public for evaluation and consideration in making their health care choices. Public

disclosure of these data elements, coupled with public education on their interpretation, will serve as the necessary catalyst to improve the care that all acute care hospital patients rcceive.

Abstract

Restructuring and Reengineering changes in patient care delivery in 29 University Teaching Hospitals in fiscal years 1997 and 1998 are described. Summary statistics and significant correlations of selected structure, process and outcome variables at the Hospital/Nursing Department and study Medical and Surgical units are presented. Hours worked per patient day (HWPPD), Registered Nurse (RN) per cent, and RNHWPPD are the structure variables correlated with process and outcomes. The process variables used are Culture, Nursing Leadership, Communication, Collaboration, Conflict Resolution, Nurse Autonomy and Decision Making, and Nurse Satisfaction. The patient outcome variables are Nosocomial Pressure Ulcers and Urinary Tract Infections, Falls and Fall Related Serious Injuries, Patient Satisfaction with Pain Management, Promptness/Attention to Needs, Education and Discharge Preparation, Nursing and the Hospital, Length of Stay, and Total Regionally Adjusted Labor Costs per Discharge. Value in Patient Care, Quality/Costs, did not come in one size fits all. No single manpower pattern resulted in best value. Policy Implications are presented.

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